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## **POSSIBLE BALL LIGHTNING COLOR PHOTOGRAPH FROM SANKT GALLENKIRCH, VORARLBERG, AUSTRIA**

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**Abstract:** A resident of Sankt Gallenkirch, Montafon, Vorarlberg, Werner Burger, reported a color diaslide of ball lightning taken in 1978. A field investigation by the author and four expert witness reports (astronomy, pyrotechnics, lightning protection, computerized photo valuation) ruled out a meteor, fireworks and ordinary lightning. The case is open to further hypothesis testing. Following press publicity, 17 more ball lightning reports emerged from the vicinity.

### INTRODUCTION

In the history of ball lightning studies, photographic cases promising some kind of physical evidence have been highlights and pitfalls. Highlights such as the US Prairie Network ball lightning photograph (Barry, 1980, 97-98) are rare. Pitfalls are more numerous, e.g. of 24 alleged kugelblitz pictures examined by Barry (1980, 79-131), only a handful survived. What is true for the spectacular Ashford video tape (Meaden, 1990; Bergstrom & Campbell, 1991) - never trust attractive optical evidence - also was the research motto for the following Austrian case. A preliminary study is finished now, and case details and analytical steps are presented extensively here to give J.Meteorology readers an opportunity to develop their own hypotheses.

Werner Burger, eyewitness and photographer of the color slide, contacted the author after a press call-for-reports in early 1990. He sent glossy copies in summer, and in September 1990, Keul went to Vorarlberg for a field investigation. The case remained interesting, so copies of the photo plus reports were distributed to four experts asking for their opinions on astronomical, pyrotechnical, and atmospheric electrical aspects and submitting the photo to a computer-based enhancement and image analysis. In spring of 1991, all four reports had been sent to the author. The case was released to the Austrian press in summer. This resulted in 17 additional ball lightning reports forthcoming from local residents. Two more field trips were done to interview witnesses.

### VISUAL OBSERVATION AND PHOTO-TAKING SITUATION

In a summer night of 1978 (date not known) Werner Burger watched an approaching squall line at Sankt Gallenkirch, Vorarlberg Federal Province (western Austria) at about 10°E longitude/47°N latitude and 900 meters above sea level. Sankt Gallenkirch has 1.400 inhabitants and 2.000 tourist beds. It lies in the Montafon Valley of southern Vorarlberg, surrounded by mountain ridges of over 2.000 meters. The observation point was Mr.Burger's parents' house at Aussergant, beside the Montafon through-road. Burger screwed his reflex camera (plus wire-release) to a tripod and went out on the balcony to make time exposures of lightning flashes. The camera faced Mt.Grappeskogel (2206 m), a mountain in the east. It was dark and before midnight.

Burger was just taking another time exposure, so the camera shutter stood open and the wire-release was pressed down, when he heard a peculiar sound, suddenly, "like an Xmas sparkler or a wire-brush moved over an edge [intermittently]." Then, just ahead, "a fireball fell down" and Burger -somewhat shocked- let go the wire release before the object actually disappeared. When asked to re-imagine the course of events with his eyes closed, the witness gave a time estimate of three seconds total duration with two seconds visual observation time (repeated stop-watch readings). The "fiery" object seemed to drop "in free fall".

The 1978 lightning photographs were taken with a one year old FUJICA AZ 1 reflex camera, with a FUJINON lens 1:1,8; f=55mm, 30mm front lens opening. The camera focus was set to infinity, the exposure handle to "B" (time exposure). The f stop is unknown (range: 1,8 to 16), use of a skylight filter possible. The camera was mounted on a simple movie-camera tripod, so a blurring of the photo could not be ruled out. The photographic material was an AGFA (Western Germany) CT-18 50 ASA color slide film no longer manufactured now. The slides were developed soon after the exposures. The alleged ball lightning photo

has running number 16/17 on the film roll. Burger still keeps slides no.26/27, 28/29 and 32/33 of this film showing lightning strokes. The overexposed rest was thrown away.

## LOCATION, DATE AND WEATHER

The Mt.Grappeskogel summit (2206m), measured with quadrant and compass from the observation spot, has 25° elevation and 100° azimuth (nearly east). As the summit forms the center of the three linear lightning photos and Burger said he did not move the tripod, it can be assumed that the camera axis also pointed that way when the kugelblitz fell. The terminal fall area -open farmland and meadows- lies behind a neighbor's house, trees and a pole of the local power line (visible on the lightning photos; see **figure 1** for a rooftop view).

The witness guessed from notes on his 1978 slide-cassette that the photos had been taken between April and September. It was dark, around midnight, the sky overcast. When the squall line passed over the location, some rain fell. Otto Svabik from the Climatology Department of the Central Meteorological Office, Vienna, a study colleague of the author, helped by scanning the climatological records of three Vorarlberg stations - Bürs near Bludenz, Vandans and Partenen. Thunderstorm observations were made on July 9/10, August 3/4 and 6, 1978. According to Svabik (1991), the August 3/4, 1978, night thunderstorms probably were the date of the ball lightning case: "A thunderstorm front crossed Austria at that time, causing widespread damage." Rainfall was 6 mm at Vandans and 1 mm at Bürs.

## WITNESS AND FORENSIC PSYCHOLOGY

Werner Burger, born in 1957, is currently employed by the Bludenz district court. With his wife Anneliese he runs a tourist boarding house. The family has three children. In 1978, Burger was working for the Silvretta cablecar company. Burger's eye-sight is normal. He likes to paraglide, climb and photograph in his free time. From tales of his grandfather, he knew a bit about ball lightning. He showed the diaslide to several people who could not identify it, so it eventually went into the drawer for 12 years.

Is it possible to keep a precise memory about seconds of a chance observation 12 years ago? Forensic psychologists have done numerous experimental studies about eyewitness testimony, but on other contents, situations and latency periods (time lag between observation and memory situation) than ball lightning. Some interesting findings of this research tradition: Outstanding details of an action sequence are remembered excellently (98%; Marshall, Marquis & Oskamp, 1971). Central details of an action scene are reported clearly even when they caused fear (Kebeck & Lohaus, 1986). Persons tend to overestimate the duration of fear- and stress-loaded events (Sarason & Stoops, 1978). Observed details can be distorted by suggestive questioning upon retrieval (Carmichael, Hogan & Walter, 1932) as well as by personal and cultural stereotypes. Emotionally upsetting, consequential events are often memorized together with irrelevant details of the event situation ("flashbulb memory"; Brown & Kulik, 1977). Falsely remembered details are consistently memorized in this wrong way ("freezing effect"; Kay, 1955).

To escape the Carmichael et al. distortions, the author gave no clues at all when doing the field interview. Mr.Burger showed a "flashbulb memory" remembering the smell of apples his mother had cut in the kitchen when he came in again after his observation at the balcony. A possible source of error is the overestimation of stressful event durations.

## ANALYSIS OF THE PHOTOGRAPH

The original diaslide frame measures 23x35 mm (**figure 2**). It is different from the three bluish-violet, overexposed linear lightning slides by having no clear background. Above a dark and blurred bottom line and a central, diffuse "cloud", a curved light trail runs from the left upper corner down to the middle of the frame, starting faintly, then shooting out "sparks" to the left, flaring up and terminating suddenly (witness shocked, released the shutter).

Contrary to most ball lightning cases, we here have a color photo as back-up. The photo analysis was meant to clear up the following questions:

1. Are there hints for a solid luminous object?
2. Are there distance cues to be used as size cues?

3. What is the information to be extracted from the faint luminous trail and the "sparks"?
4. Could this be a fireworks rocket? Why (not)?
5. Is this an astronomical phenomenon? Why (not)?
6. Is this an ordinary lightning discharge? Why (not)?

These questions together with case data, contact and paper copies of the photo were handed over to the expert witnesses.

Written expert opinion of Dr. Zdenek Ceplecha, senior meteor astronomer with great experience in interpreting meteor photos, Ondrejov Observatory, Czechoslovakia (1990):

- "1. The strongest indication that it is a solid body obeying gravity field, is the near parabolic shape of the fainter trail .. 2. If the dimension of the fainter main trail was 10 cm, it was 40 m apart from the camera. If the dimension was 1m, it was 400 m apart. .. 3. The shape of the sparks has certainly nothing to with an assumed 'motion of the camera'. Even the two longest and brightest sparks have different trajectories. .. the good focus .. speaks for a quite stable camera .. 4. There is no reason why it could not be a firework rocket. There are types of them with retarded explosion. 5. Certainly - it is not a fireball [bright meteor-A.K.] trail."

Verbal expert opinion of Claus Feuerstein, pyrotechnist of a Salzburg fireworks company (1990) to the question 'Could this be a fireworks rocket?':

"Actually not. Fireworks rockets have a propulsion part with magnesium powder, like Xmas sparklers, and an effect portion. There are propulsion parts with 'comet ascent', but this is not the case here, here the head is burning, which is completely unusual with fireworks objects. The trail, too, does not fit in with fireworks. Such 'sparks' are not present in pyrotechnics, .. military-like .. Drops with an afterburn, .. like burning gas or liquid, ignited, thrown out, flaming up."

Verbal expert opinion of engineer Alfred Gugenbauer, sworn expert witness for lightning protection, senior of the Upper Austrian

Lightning Protection Society, Linz, Austria (1990) about the question 'possible connection with an ordinary lightning stroke':

"The ramifications point towards lightning, also the way-off luminous structures. .. It looks like an upward lightning stroke - straight line and ramifications. .. The [upper] 'trail' then would be an ionization current of 100-200 Ampere, ... a long-time current .. It surely was a lightning process, the ramifications are specific. .. nearby, the sound is typical, plus a sharp bang. I suppose it to be an upward lightning phenomenon. Great, that he got it as he did."

Written expert opinion of Dr. Peter Marx, Image Processing Scientist [professional photographer, systems analyst and image processing expert of medical scans], Department of Medicine, UCLA, Los Angeles, USA (1991):

"[The] color 35mm slide [was] digitized using a high resolution scanner (Barneyscan..) into a[n Apple-] Macintosh computer. The digitized image was then processed through a variety of software applications, including Spyglass Transform and View, NIH Image, and GreasePencil. The processing types included high-pass filtering, contour mapping, gray-scale and component transforms, histogram analysis, windowing, and other filtering. The resulting images are discussed below.

1. Examination of the original image demonstrated a long process starting in the upper left corner and proceeding into the luminous object. This process was enhanced via window width and level changes to produce **[figure 3]**. .. The image intensity of the process is approximately 12% different from the processes surroundings.
2. The inner area of the luminous object is demonstrated in **[figure 4]**. The area was selected via a contour-following tool that determines the boundaries based upon a percentile change in pixel intensities. Using histogram equalization and windowing, the inhomogeneity of the inner region was then enhanced as shown. The image intensities within the inner area differ by less than 3% throughout the area.
3. The object's surrounding area (outside of the inner area and above the background threshold) is shown in **[figure 5]**. This figure is a contour map of the entire image with the levels set to 91, 142, 183, 224, and 255 (from red, green, and blue components, each utilizing an 8-bit scale ranging from 0 to 255). This resulted in a map [which] demonstrated a 'multiple halo' effect of the inner area; there are three distinct contours shown, not including the innermost one. Note that there is an effect resembling turbulence in the upper left side of the image.

.. The images are uncalibrated without references and the only morphometric analysis that can be performed is one based upon pixel counts. .. Finally, a note about the striations shown about the inner area; these patterns are common in photos with flaring. .. the small, bright processes leading away from the inner area are diffuse and ill defined, perhaps due to their high speed relative to the shutter speed. Note that the long process leading from the object to the upper left .. is relatively well defined, leading to the conclusion that the photographer [or, rather, the tripod -A.K.] was steady during the exposure."

## DISCUSSION

Does the Sankt Gallenkirch case fit in with other Austrian kugelblitz data? A statistical evaluation of 150 Austrian cases (Keul & Schwarzenbacher, 1989) showed 80% summer observations, a 70% thunderstorm connection, more than 90% single object events and about 70% durations up to five seconds. The median of the reported diameters is 25 centimeters. 60% of the objects were red-orange-yellow, 14% emitted "sparks". Therefore, the photographic and visual case details from Vorarlberg are "good average".

The photo-analysis cleared up some points in question: Meteor astronomer Cepelcha ruled out a bright meteor [in front of the clouds?] and estimated the "faint trail" cross-section to be one meter for a distance of 400 meters. Pyrotechnist Feuerstein said it was no standard fireworks rocket. Computer image analyst Marx, after enhancement of the photo, described a multiple halo effect and turbulence signs of the object's surrounding area. Parts of the "flaming/spark" details may be striation due to lens flare. According to astronomer and image processor, the camera position was steady during the exposure.

Lightning protection specialist Gugenbauer assumed a stroke of upward lightning as an explanation. His hypothesis is consistent, but neither fits the observational data nor other case details. An observer would not describe a nearby stroke as a ball falling down for seconds. A logical foot-point for an upward discharge would be the local power-line pole. Why was it not illuminated and captured on the ball lightning slide? Why was the camera axis -within a series of lightning photos pointing at 25° elevation (Grappeskogel)- now pointing at a horizon object (to be the foot-point the pole would have to be in the center of the lightning photo)? A ground stroke also would have resulted in a black-out and traces at the pole which were not observed.

Several questions remain after this first steps of analysis:

Why did no terrestrial details at all show up on the kugelblitz frame? What could be the physical nature of the faint luminous track and the "sparks"? Is it possible to produce such an image by trick photography? Further interdisciplinary scientific study of the Sankt Gallenkirch photo will yield more interesting results. The J.Meteorology readers are invited to form their own hypotheses about this case and to forward them for empirical tests.

## 17 MORE KUGELBLITZ CASES

After the photo-analysis was finished, the case details were released to the Austrian press. A story with color photo was carried by the local "Vorarlberger Nachrichten" on July 25, 1991, and another appeared in the newspaper "Kurier" all over Austria the next day. The photo was talk of the day in the alpine valley - wherever he went, Burger got comments on it. However, calls-for-reports by the press and by two touristic newsletters yielded nothing.

Within the following weeks, Werner Burger was told about 30 reports/report traces. People did not write, but they spoke. 22 of the reports could not be identified as ordinary lightning effects. 20 of them had happened in Vorarlberg, 17 within a radius of seven kilometers around the center of Sankt Gallenkirch. All events were personally investigated by the author during two field trips to the area in 1991. As new reports are still forthcoming, only a preliminary statistics is given here: Eleven objects were seen near the ground, ten lasted for two or three seconds (stopwatch estimates), nine had a reddish color. Four objects allegedly exploded and/or caused damage.

The "Montafon cluster" (as we named it) offered a unique chance to speak to residents (nine are farmers or herdsman) who did not respond to call-for-reports because kugelblitz was something "common", not even especially exciting, for them. For our photo case examination it is of interest that since 1933, and especially in the sixties and seventies (five cases each), ball lightning was observed frequently at Sankt Gallenkirch, Vorarlberg.

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#### REFERENCES

- BARRY, J.D., 1980: Ball lightning and bead lightning. New York: Plenum.
- BERGSTROM, A., CAMPBELL, S., 1991: The Ashford "ball lightning" video film explained. *J.Meteorology, UK*, 16, 185-190.
- BROWN, R., KULIK, J., 1977: Flashbulb memories. *Cognition*, 5, 73-79.
- CARMICHAEL, L.C., HOGAN, H.P., WALTER, A.A., 1932: An experimental study of the effect of language on the reproduction of visually perceived form. *J.Exp.Psy.*, 15, 73-86.
- CEPLECHA, Z., 1990. Personal communication.
- FEUERSTEIN, C., 1990. Personal communication.
- GUGENBAUER, A., 1990. Personal communication.
- KAY, H., 1955: Learning and retaining verbal material. *Brit.J. Psy.*, 46, 81-100.
- KEBECK, G., LOHAUS, A., 1986: Effect of emotional arousal on free recall of complex material. *Perc.Mot.Skills*, 63, 461-462.
- KEUL, A.G., SCHWARZENBACHER, K., 1989. Phenomenological and psychological analysis of 150 Austrian ball lightning reports. In Ohtsuki, Y.H., Science of ball lightning. Singapore: World Scientific, 58-80.
- MARSHALL, J., MARQUIS, K.H., OSKAMP, S., 1971: Effects of kind of question and atmosphere of interrogation on accuracy and completeness of testimony. *Harvard Law Rev.*, 84, 1620-1643.
- MARX, P., 1991. Personal communication.
- MEADEN, G.T., 1990: Preliminary analysis of the video recording of a rotating ball-of-light, 10 September 1989. *J.Meteorology, UK*, 15, 128-140.
- SARASON, I.G., STOOPS, R., 1978: Test anxiety and the passage of time. *J.Cons.Clin.Psy.*, 46, 102-108.
- Svabik, O., 1991. Personal communication.

#### FIGURE CAPTIONS

**Figure 1.** Terminal fall area of the kugelblitz with Grappeskogel in the background. View from rooftop of the Burger boarding house (neighboring building to parents' house).

**Figure 2.** Paper print of the possible ball lightning color slide taken by Werner Burger, Sankt Gallenkirch, Austria. Because of irradiation in the duplicating process the background is much darker than in the original photo.

**Figure 3.** Computer-enhanced image of the possible kugelblitz track, "sparks" and flaring, produced by Peter Marx, UCLA.

**Figure 4.** Computer-enhanced inner area of the possible ball lightning flaring process, produced by Peter Marx, UCLA.

**Figure 5.** Computer-enhanced flaring process, surrounding area and "sparks" of the possible kugelblitz, showing "multiple halo" and "turbulence signs", produced by Peter Marx, UCLA.

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